OMNI-LER1 Satellite Technical Description

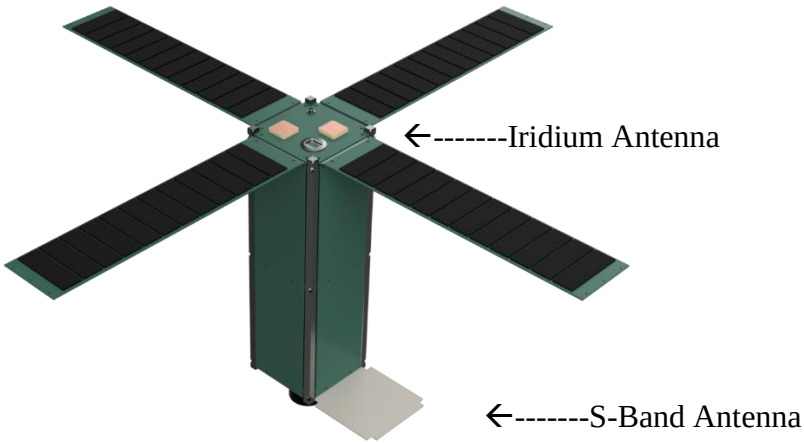
The overall goal of the OMNI-LER1 mission, is to conduct research experiments of on-board blockchain technology to measure performance, behavior, latency, and reliability of blockchain transactions in LEO. Experiments will include transactions of data acquired from on-board sensors and use of smart contracts for automated transactions.

The data will be obtained by collecting Earth images, radiation, and onboard sensory data for transacting as part of blockchain transactions. Blockchain and system data will also be logged. The data will be analyzed by researchers at Internet Think Tank to measure blockchain behavior and to identify any anomalous behavior in the blockchain.

The satellite will be launched as a secondary payload aboard the SpaceX Falcon 9 Teleporter 7, from Cape Canaveral, no earlier than January 31, 2023. It will be inserted into a circular SSO orbit at 550 km, on an inclination from the equator of 97.6 degrees. Transmission will begin 30 minutes after satellite deployment, and cease 2 years later. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 3 years after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single unit with the dimensions of 3 stacked 10 cm X 10 cm X 10 cm CubeSat modules (giving an overall dimension of 10 cm X 10 cm X 34 cm.) The total mass is about 3.5 Kg.

Figure 1 OMNI-LER1 Overview.



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The satellite contains the following systems:

Guidance, Navigation and Control (GNC) Subsystem: The GNC is a pitch momentum bias system using three reaction wheels for momentum, and torque coils built into the structure to cancel environmental torques. The equipment complement of torque coils, triaxis magnetometer, and reaction wheels are the critical components in this subsystem. Additional hardware being flown but not required for flight control include a GPS receiver, and a sun tracker.

Command and Data Handling (CDH) Subsystem: The three critical printed circuit boards in the CDH subsystem are the Main Board (MB), Daughter Board (DB) with sensor controls, and the Watchdog (WD). The WD board operates regardless of flight computer operating state. The DB includes all communications interfaces to the transceiver the MB performs basic spacecraft state of health maintenance.

Communications Subsystem (COMMS): COMMS uses 2 radios:

1) The LibreSpace S band transceiver, with an Endurosat patch antenna. This will communicate with ground stations in Akron, PA and Villanova University, Villanova, PA.

2) The RockBLOCK 9603N Iridium transceiver with integral antenna. It will support bidirectional communications with LER1 mission operations, via the Iridium satellite network.

Electrical Power Subsystem (EPS): The EPS is a direct energy transfer system using a solar array producing approximately 14.7W of orbit average power to charge the 6.4 A-hr battery system. The solar arrays utilize AnySolar photovoltaic cells; the batteries are COTS Panasonic 18650B cells.

Thermal Control Subsystem (TCS): The TCS controls hardware temperature through cold biasing of the thermal design, utilizing copper heat transfer blocks to stabilize temperatures. Sensors are wired to the sensor daughterboard, which hosts thermal control algorithms to control the heaters.

Structure Subsystem: The structure is fabricated of Windform XT 2.0 from CRP Industries. The solar panel backing is 1.6mm FR4.

Propulsion Subsystem: The Applied Ion Systems Vacuum Arc Thruster (VAT), is an electric propulsion system using a bismuth based propellant. It is not a pressurized system.

Payload Subsystem: The payload includes the Earth Observation EO system, the primary Blockchain Experiment (BCE), and twin radiation dosimeters (EX1). EO is performed via a Raspberry Pi Hi-Quality camera with a 50mm lens, interfacing directly to the MB. The BCE is comprised of dual Raspberry PI Compute Modules (CM4) and twin Solid-State Drives (SSD). EX1 consists of (Teviso) BG-51 dosimeters. One of these dosimeters is covered with anti-radiation coating made of Lead Zirconate Titanate.